Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 116)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 5x^5 - 4x^4 - 10x^3 + 2x - 1$$

$$q(x) = -5x^5 - 7x^4 - 8x^3 + x^2 - 9$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (5)x^5 + (-4)x^4 + (-10)x^3 + (0)x^2 + (2)x^1 + (-1)x^0 \\ q(x) &= (-5)x^5 + (-7)x^4 + (-8)x^3 + (1)x^2 + (0)x^1 + (-9)x^0 \\ p(x) + q(x) &= (0)x^5 + (-11)x^4 + (-18)x^3 + (1)x^2 + (2)x^1 + (-10)x^0 \\ p(x) + q(x) &= -11x^4 - 18x^3 + x^2 + 2x - 10 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 6x^2 - 3x + 2$$

$$b(x) = -5x + 8$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$6x^2$	$-3x$	2
$-5x$	$-30x^3$	$15x^2$	$-10x$
8	$48x^2$	$-24x$	16

$$a(x) \cdot b(x) = -30x^3 + 15x^2 + 48x^2 - 10x - 24x + 16$$

Combine like terms.

$$a(x) \cdot b(x) = -30x^3 + 63x^2 - 34x + 16$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -2x^3 - 19x^2 - 24x + 2 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & -2 & -19 & -24 & 2 \\ -8 & & 16 & 24 & 0 \\ \hline & -2 & -3 & 0 & 2 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -2x^2 - 3x + \frac{2}{x+8}$$

In other words, $h(x) = -2x^2 - 3x$ and the remainder is $R = 2$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -2x^3 - 19x^2 - 24x + 2$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (-2)\cdot(-8)^3 \;+\; (-19)\cdot(-8)^2 \;+\; (-24)\cdot(-8) \;+\; (2) \\ &= (-2)\cdot(-512) \;+\; (-19)\cdot(64) \;+\; (-24)\cdot(-8) \;+\; (2) \\ &= (1024) \;+\; (-1216) \;+\; (192) \;+\; (2) \\ &= 2 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x+8$. Thus, $f(-8) = 2$.